Accessible Power-Assist Hospital Bed
Back Angle Controller

Project Statement

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Statement of Need

A large number of people encounter difficulty adjusting themselves in hospital beds due to their physical limitations. This would apply to those patients with limited mobility and dexterity associated with conditions such as Parkinson’s disease, paralysis, arthritis, obesity, and other disabilities. The problem with current powered hospital beds is they have a slow constant velocity and use open-loop controls to set the back angle. These controls require a certain level of dexterity that some users may not have. The power-assisted hospital bed design needs to accommodate the patient’s handicap and allow for them to be easily adjusted.

Basic Preliminary Requirements

This power-assist hospital bed back angle controller must be easily accessible to a caregiver to adjust the back angle of a patient. Rather than fumbling with a hand held remote to adjust the bed, the care giver will be able to pull on a handle and lift the bed back and patient. The care giver and patient will be able to apply a small force to the handle, and then that force will be multiplied so as to allow someone who can only lift 5 pounds to be able to lift 180 pounds. The movement of the bed back will be natural, so that when a larger force is applied to the handle the bed will incline at a faster rate, where as when a smaller force is applied, the bed back will incline at a slower rate. This device will be applicable for patients of up to 400 pounds, assuming that 180 pounds or 45% of the person’s total weight will be concentrated on the bed back. The handle will measure an input force between 1 and 20 pounds, which will be multiplied greater than 180 times making the patient seem nearly weightless.

Basic Limitations

A number of concerns arise from the proposed project. First and foremost, the design must be safe for the patient. This is particularly important because many of the users will already be weakened and especially at risk of additional injury. The bed must be able to be locked in position if movement would harm the patient. Also, the maximum speed of the bed should not be so high that patients who are not familiar with the system and push the handle too hard are startled.

Another concern stems from the fact that this is a powered device. Due to its nature, users will be in contact with it often. All the electronic parts must be properly insulated to prevent shock. The bed must also be stable if power is lost, even if it is lost while moving. The device must also be easily sterilized to impede the spread of disease between patients using the bed. The components of the
device that are exposed, such as the handle, cannot be overly large or bulky so the bed can be easily transported. Also, the handle portion should be capable of being quickly and easily detached if it impedes urgent care.

Other Data

The clients that this device is being designed for have a wide range of disabilities. The first client is a 60 year old male that suffers from chronic back pain due to his previous profession of 30 years as a home health nurse that required heavy handling to help the patients sit up-right in bed. This client has mild hearing loss and suffers from carpal tunnel syndrome. The second client is a 69 year old retired woman that sleeps in a hospital bed. She has Parkinson’s disease with some tremors and as a result has limited mobility and dexterity. The third client is a 31 year old lady who was recently in an automobile accident that resulted in partial paralysis of her right side. This is inconvenient because she is right handed and she doesn’t want a lot of complicated medical devices in her room. The fourth client is an 86 year old that is deaf, has severe arthritis, and heart problems so that she is confined to a bed. Her 11 year old grandson has a fascination with electronics and helps her with her therapy and helps her sit up in bed. All of the clients want to be able to operate the device with ease.

Questions

- What is the optimum placement of the handle so that everyone can reach it comfortably?
- How long should the handle be so that it is easily usable but does not get in the way?
- How sensitive should the device be so that it is not activated when accidentally touched but is still usable for weakened patients?
- What assistive lifting apparatus should be used?
- How does the device measure and apply the input and output forces on the handle?
- Does the device adapt to both right and left sides of the bed?
- Is the device simple enough for any level of mentality to figure it out?
- Is there a safety mechanism or lock on the device?
- Is this device protected from liquid spills?
- How will this device be able to work with several kinds of platforms or beds?